with several thicknesses of brown paper and is ready for the cover. which may be of paper, cloth, or leather.

FINISHING: The putting on of gold letters and designs is a very difficult process, and could only be done by the oldest pupils. It is, however, possible for the children to do considerable decorating and lettering in other ways. Generally it is possible to make satisfactory arrangements with job binders to furnish the necessary supplies for such binding as is done in the schools. They are usually willing, also, to do the necessary cutting of material.

MACHINERY AND SUPPLIES: The following is a small outfit for a bindery. It is, however, possible to do very fair work in a school-room with less machinery. Prices vary considerably, and are, therefore, not given here, but they may be readily obtained of any firm dealing in binders' supplies:

1 pair of compasses. 1 square. 1 bone folder. 1 glue-pot and brushes. Paste-pot and 2 paste brushes. 2 cutting and paring knives. 1 pair of editor's shears. 1 awl for stabbing. 1 gas stove. 1 forwarder's hammer. 1 edge scraper. 1 sewing bench, 24 inches between screws. 2 12-inch backing boards. 1 lettering pallet. 1 fillet roll. 1 finishing press. 1 gold cushion. 1 small standing press. 2 sets of brass types. 1 package of binders' needles, 1 blunt, and 1 sharp. 1 pound each of Hayes' Irish linen thread, Nos. 18, 25, and 30. 1 pound each of soft twine, Nos. 3 and 4. 1 bundle of tar boards and one of straw boards. 1 package of gold-leaf. Canvas, cloth, leather, and papers.

**References:** The following list of books will be found helpful in practical binding, and also for the history of book-making. Zaehnsdorf gives the best practical description of binding:

Aldrich, *Friar Jerome's Beautiful Book*, Houghton; Bouchot, *The Book; Its Printers, Illustrators and Binders*, Grevel; Gunsaulus, *Monk and Knight; Historical Study in Fiction*, McClurg; Horne, *Binding of Books*, Kegan Paul; Matthews, *Book-Bindings, Old and New*, Bell; Putnam, *Books and Their Makers in the Middle Ages*, 2 vols., Putnam; Zaehnsdorf, *Art of Book-Binding; a Practical Treatise;* Technological Handbooks, Bell.

# Number as Related to Meteorology in the Primary Grades

Flora J. Cooke

During the past month several letters from teachers have been received inquiring as to the value of keeping a daily record of the local weather conditions and amount of number work necessitated by such work in the primary grades.

Judging from the interest thus manifested and the number of symbolic and pictorial charts and calendars which have recently appeared in the kindergartens and schools of New York, Boston, Washington, Minneapolis and San Francisco, this is a subject of universal interest to primary teachers at present.

There seems to be but one general answer to the questions stated above: To be really valuable and educative this work must directly feed the child's genuine joy and appreciation of nature's phenomena. He uses number only because it will help him to find out what he wants to know.

If, on the other hand, this subject is chosen merely because it affords an opportunity to drill the children in fractions or so-called fundamental processes of arithmetic, wooden blocks would be a much more direct means to the end desired and the child's attitude toward nature would be less apt to be strained and pretentious.

In last year's *Inland Educator* a somewhat detailed outline of this phase of our work was given, and because it answers most of the questions asked, part of the article is quoted below.

In all of this work it is the teacher's duty to judge from the attitude, experience and questions of the children what they will care to measure definitely and what is worthy of their efforts. As in the choice of reading, she must examine their fundamental interests for help. The following work in meteorology might well be criticised as being too analytical for little children, because the motive for the selection of this work and the great variety of devices attending the study are not given. Some of the children got nothing from it but the habit of looking daily with pleasure at the sky, water, plants and animals in their environment; but surely such observation was not wholly without good effect, and incidentally the work provided opportunity in almost every line of activity which children enjoy. They made and regulated their own weather signal-flags, rain-gauges, etc. They expressed their observations by means of writing, drawing, painting, colored crayon illustrations, plays, dramatic personification and original stories. Selected stories, poems, songs, rhymes, and riddles constantly allowed the same things, in another form, to act upon them, and the test of the value of the work came in the children's increasing delight in and their desire to know more about these familiar things.

The following outline presents the number aspect of the work in meteorology for an entire year, as all the questions asked pertain to this phase of the work.

The examples, though crude in themselves, yet use number only for its one purpose—to make some mental image clearer.

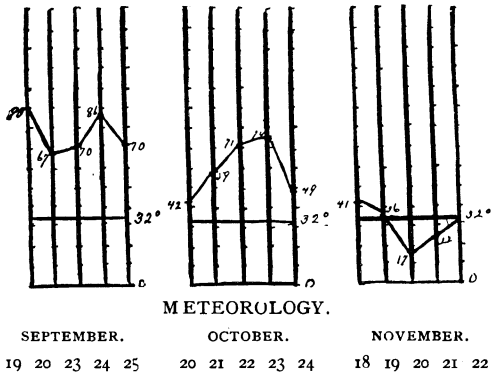
TEMPERATURE.—The children judged that it was cooler in the shade of trees and in the house than in the sunshine. To verify their judgments the use of the thermometer as a tool for measuring heat was necessary.

The numbers and lines upon the thermometer may be read: zero, 1 ten, 1 ten and 2, 1 ten and 4, 1 ten and 6, 1 ten and 8, 2 tens, three tens and 6, 4 tens; and the names twenty, thirty, forty, etc., reviewed until the children are familiar with their meaning. This makes the reading of the thermometer perfectly simple.

The children recorded the outside temperature and that of the room at a given time every day. They discovered the temperature of the soil at a certain depth, where the ants live, where the earthworms live, and in the garden, where the vegetables live. They compared the temperature under their trees with that in the sunshine, that of the water at the surface with that at the depth where the fishes live.

The record of all these experiments was kept upon a large chart, and used for reference by the children. At the end of each month they were able to construct simple charts for their individual records. A series of parallel lines with dots at regular intervals were drawn to represent the scale of the thermometer by tens. At the 32 point and at the zero point lines were drawn all the way across the chart. At the top of each line stood the number indicating the day of the month, and above all stood the name of the month. By connecting the temperature recorded at, say 9 A. M. one day, with that on succeeding days the record was completed. These data were gathered by the children and recorded daily at 9 A. M. The children noted the direction of the heat line in each case. They compared these charts with their paintings of landscape, plants, and animals during these months, also with the data of their sunshine charts. In many cases the children discovered the relation between the descending heat line and the changes which they had recorded.

TEMPERATURE CHART. — The children constructed a chart upon which they recorded the number of clear, fair, cloudy,




rainy, and snowy days in September, October, and November. They obtained the data from their large schoolroom charts, which were the results of their own daily observations. Upon these charts the clear days were represented by bright yellow circular disks, the fair days by dull yellow, the cloudy days by dull gray, the rainy days by dark gray, the snowy by light gray. The disks were all of a uniform size. They were cut and pasted upon the chart in such a way as to show plainly, through the different coloring, the changes in each day and thus in each month. Frost was represented by a small white circle. Each month's chart was the size of the leaves of their books—11 by 8½ inches. After a half-inch margin was taken off from one end and side, the space was divided into three equal parts—one for September, one for October and one for November. See outline for Nature Study, October COURSE OF STUDY, page 128.

The children made a working plan upon the blackboard before using the material designed for the chart. They divided each month's space into four equal parts—one for clear, one for cloudy, one for fair and one for rainy and snowy weather.

They counted up the entire number of days of sunshine in each month—fair, cloudy, etc. With their self-made circle-makers they constructed the necessary number of circles in each column to represent the number of clear, fair, cloudy or stormy days in each month. They painted these circles the colors of the disks upon the large charts ; they experimented in mixing the paints, under the teacher's direction, until they got the exact representative colors.

When any (normal) child found difficulty in counting up the number of clear days—that is, if the adding or combining of the fractional parts of the disks troubled him—the teacher stopped and allowed all the class to help the child overcome his difficulty. As many devices were used and as long a time taken as was necessary to make the work perfectly clear to him. Through this work the children had vividly impressed upon them, with the help of the landscape painting, temperature charts, etc., the general characteristics of the fall months. For instance: September had only four cloudy school days, while November had ten and one-eighth. September had twice as many clear days as November. In September the heat line did not come nearer than 12° of the freezing line. In November it was one-fourth of the time below it. September had green grass, green leaves, many flowers, birds and insects. In November, the grass was withered, the trees bare, there were few birds, no flowers, and no insects. And thus, as many of his images combined constantly into an ever expanding image, the child unconsciously grew to feel the relative importance and interdependence of these things, and his own relation to them all.

During the spring months the first grade children were given the opportunity of expressing their observations through the medium of their newly acquired power in the use of a printed vocabulary. This had the advantage of requiring them to express themselves, individually and independently, as they searched out the sentences which they thought corresponded to

the weather conditions, and arranged them upon their disks in such a way that they might be easily read and compared.

This tested not only the accuracy of their observations but their power to recognize and associate correctly ideas and their appropriate symbols. It also created a real necessity for reading, too often absent from such exercises.

The children needed a receptacle of some kind to hold the words and sentences used in this work, and the following box was chosen as the most convenient form for it:

WEATHER BOX.—(dimensions in inches). Nine small boxes 4x1x1, one large box to hold the small boxes 12½x3½x1. The small boxes were labeled "Day of Week," "Months," "Wind," "Clouds," "Temperature," "Rain or Snow," "Frost or Dew," "Dates," and contained sets of sentences upon the subject indicated by the label.

The child of course utilizes and applies the knowledge thus gained in his other phases of nature study and in his history and geography work. As each study requires quite as much number for the formation of clear images, the only question seems to be to discover the necessity for definite images in the various subjects studied. The only sure guide as to their relative value is to note how actively such work influences the immediate life of each individual—that is, how much he actually uses the results of his work.

## Answers to Questions

"Is it possible for children to study many subjects and obtain good results?"
—Parent.

That depends. If the gaining of certain amounts of knowledge is the purpose of study, scraps of knowledge, superficial ideas only will be acquired; the powers of the pupil will be dissipated; the true purpose of knowledge will not be appreciated. Therefore, artificial and vicious stimulants for effort must be used.

If the motive of teaching is character, citizenship, community life, complete living, then knowledge becomes intellectual nutrition, by use. That knowledge will be selected for each pupil which he needs, that skill in expression which he must have to use his knowledge. There is not the slightest danger of over-burdening if knowledge is acquired under the right ideal.

"Why do some children hate mathematics?"

Because they have no use for it.

# Kindergarten

### Anne Elizabeth Allen

**Law and Order,** Continued. This month, the time for doing everything and the order observed in the home industries; the timekeeper; home preparations for winter, viz: storing of coal in basements, canning fruits, providing warm bedding and clothing, will directly supply the material for our work.

Out-of-door changes: Nature's preparations for winter will be daily observed in our excursions into the park.

Preparations for a Thanksgiving festival will begin early in the month. Teachers and children will visit the market, selecting fruit to make jelly of. The children will bring recipes for making it from home